Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Numerical analysis and simulation of diffusion-free ignition delay times of unreacted pockets JONATHAN REGELE, Iowa State University — Volumes of unreacted fluid surrounded by combustion products are observed in Deflagration-to-Detonation Transition (DDT) and unstable cellular detonations. The presence of this unburned reactant is typical of mixtures with large activation energies. Several different scales are involved in the consumption of unreacted pockets including the autoignition, diffusion, and acoustic times. Transport effects can influence the consumption rate of reactant within these pockets. In particular diffusion plays a major role when activations energies are large. In contrast, it has been shown that diffusion can play a minor role when reactive mixtures have small to moderately large activation energies. The current work focuses on the limit when diffusion effects are negligible and examines the dependence of delay time on initial temperatures and sizes. It is demonstrated that the ignition delay time is a function of both the initial temperature and the volumetric dimension of the fluid. Furthermore, the ignition delay time lies on a continuum scale with the constant pressure and constant volume ignition delay times demarcating the limiting extremes.

Jonathan Regele
Iowa State University

Date submitted: 08 Aug 2012 Electronic form version 1.4